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ABSTRACT

Papers on library architecture, which were presented at the 1982 International Federation of Library Associations (IFLA) conference focus on the effect of library networks on library design. Topics include: (1) "Some Problems in Designing of the University Library Buildings in China: A Developing Country University Librarian's View Based on His Own Experience," a discussion by Zhu Chenggong (People's Republic of China) of library facilities at the Tsing Hua (Qing Hua) University Library, located in Peking, and the need for comparison with library building design in other countries, flexibility in library space design, and cooperation between librarians and architects in designing libraries; (2) "Library Buildings in the Network Context: A Canadian Architect's Perspective" by Michael G. Werleman (Canada), which considers the responsibilities of librarians, library building consultants, and architects in library building design, and gives an example of flexible space design for a mixed-use building at Concordia University which will contain both library and non-library space; and (3) "Library Buildings in the Network Context," a discussion by Margaret Beckman (Canada) of the implications of changing information technologies and increasing library network participation on library collection space and access, staff space and organization, user needs, changing library functions and functional relationships, and mechanical/electrical/structural considerations in building design. (ESR)

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INTERNATIONAL FEDERATION OF LIBRARY ASSOCIATIONS

LIBRARY BUILDINGS SECTION

PAPERS

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SOME PROBLEMS IN DESIGNING OF THE UNIVERSITY LIBRARY BUILDINGS IN CHINA —— A Developing Country University Librarian's View Based on His Own Experience

by

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With the development of the higher education, great changes have taken place in China's university libraries since the founding of the people's republic. In 1980, the collections, the personnel and the gross building areas of the university libraries throughout the country increased by four or five times as many as those in 1956; yet these increases could neither meet the needs of the dramatically increased readers nor keep pace with the speed at which collections are required to increase. At present university libraries can not yet serve their readers in a satisfactory manner. The reason to this is partly due to the limitations of the material conditions, and one of the most important reasons is the severe shortage of library building.

The main library building of Tsing Hua University was built in 1919 and extended in the 1930's, its total building area being 7300 square meters. At that time, collections were not more than 300,000 volumes and readers not more than 1000, whereas today our library has got no less than 2 million volumes and possessed nearly 20,000 readers, with the building area of the library enlarged by only 2000 square meters. This has naturally caused the book stacks and the reading rooms to be over burdened, and the need for more reading rooms and more stacks becomes quite urgent. In view of this situation, the leadership of our university has decided to build new library buildings.

While making preparations for the designing of the new building, we visited some libraries of other universities and institutes, compared their experiences with those of our own and then learnt lessons from them. We have also studied some other countries' data about the construction of a

modern library, and consulted some specialists in the Architectual Designing Academy. Through our own studies and preparations for the construction of the new library building, we realize that, because of the specific function of the library itself and the special demand of its construction, the architecture of the library building is indeed quite complex. Its planning and location in the campus must not only serve the particular and present condition of the university, but also, and what is more important, must serve the main idea of design and the future demand, that is, they must conform to the requirements of its services, the ways of its management and adoption of modern means and so on. Only when these problems are solved satisfactorily, can we work out a general plan and give the architectual academy the task of designing of the new building. It is clear that there are a lot of problems for the librarians to consider and study.

After carefully studying and discussing, we notice that the university library in our country is now undergoing a transition from traditional services and management to modern services and management. How can a library building be designed in accordance with the present and the long-term needs of the university? This has now become a subject of particular concern of both the librarian and the architect. We think that after the decision of its size and site, there are three questions to which priority should be given:

1. How do we make use of the experiences of the library building design in developed countries for reference?
2. How do we maintain a proper balance in the relationship between the present and the future interests and how do we bring into full play the flexibility of the functions of the library building?
3. Concerning the cooperation between the librarian and the architect.

The following is our own views on the subject, which are derived from our own experiences. We welcome any criticism and advices from our colleagues and the architects.

I. Learning From Other Countries and Starting From the Existing Conditions of Our Own Country

In recent years, our government has been carrying out an open-up policy,

and has been developing academic exchanges with other countries. More and more information and experiences about the library cause and its constructions are introduced into our country, and this provides us with a good opportunity of studying and learning from them. It enables us to use their experiences for reference to develop efficiently the services of our country's university library.

Around the Second World War great changes were taking place in the libraries of the developed countries, especially in the libraries of the universities. Open-stacks are widespread in the university libraries. Since then, the contents of the library service have become more and more varied and richer, including information work, academic exchanges, circulations, cultural popularizations, audio-visual materials and etc. Various modern means such as photo reproduction, computer, conveyer system and so on are widely employed. Meanwhile, there has also been a great change in the construction of the library from its form to style and inner functions. Now there has come into general use a new type of library structure —— the so-called modular building, which has closed air-condition, artificial illumination, flexible isolated individual study areas.

We should carefully study and learn good experiences about the construction of a library building from abroad as long as they are useful for the development of our own university library. It is important that as to foreign experiences we must at first distinguish non-essential experiences from essential experiences. And then, we must start from the reality of our own country and from the practical condition of our university. We think that the essential points in the development of the library abroad are as follows: insisting on the policy of first consideration of services; giving convenience to the readers, raising the working efficiency and practicing open-shelf reading; developing more flexibility and suitability of the library building; making full use of computers and other modern devices. In our country, as we know, the economic level is low; science and technology are relatively backward; only the human and natural resources are abundant. In addition, the histories of the universities of our country and their developments are all varied. So, if we want to bring the foreign experience into full play and make an optimum design of the library building, we must try hard to make possible a proper combination of the good foreign experiences with the actual conditions of our university and of those our country.

Most of the foreign university libraries have adopted closed air-conditioning and artificial illumination, which are undoubtedly good for the preservation of books and materials, and to make comfortable conditions for reading. Yet, in view of the economic conditions of our country, we deem that, it is impracticable to adopt such facilities in most areas except in some places where they are indispensable because of the particular climates. The reason for this is that the standard of this architecture is too much delicate, the consumption of energy too much high, and the expenditure of maintenance too much costly. So in designing our new library building, it will be advisable to adopt partial air-conditioning so as to protect the rare books, delicated valuable materials and micro-films, microfiches, tapes and so on. As for common reading-rooms, it will be advisable to adopt natural light as main measures with artificial illumination as auxiliary; and to adopt natural ventilation as main measures with mechanical ventilation as auxiliary. As for the means of transportation, we shall use the mechanical system only in vertical transportation for the purpose of saving investment and energy; for the horizontal transportation, we shall use book trucks as main means of conveyance.

In some developed countries, the development of science and technology is very rapid, and books and materials increase sharply, so they are liable to be out-of-date and some of them are obsolete even in six or seven years. However, it is not the case in our country. Take the particular situation in Tsing Hua University for example. The collections are generally much longer in use than those in the libraries of the developed countries. In addition, there has not yet been any district periodical storage center in our country now. The dead line of reserving the past periodicals in the university should be extended. It is improper to take such measures of rejecting or disposing of materials and periodicals at an early time as have been taken in foreign countries. This is the way helpful to the readers who want to look back for something. For this reason, the space floor of the periodical stacks should be designed comparatively larger.

Tsing Hua University is a poly-technic institute of science and technology. Two-third of its collections are professional which account for the main part of the collections. Our library has systemetically collected quite a lot of social sciences books and foreign literature books in order to popularize the education of culture and history of college students, and to satisfy omnivorous readers —— readers who read extensively. We have also collected quite

a lot of thread bound Chinese books, which are important means and basis for people to investigate and research into the development of the history of China's science and technology. Many of them are rare books, the editions are precious relics of our country. Such books are worthy reserving and ought'nt to be disposed of as the out-of-date. They will also have to be provided with some occupation space for the storage.

Now that there is a shortage of domitories and classrooms for the graduated and undergraduated students in our university, and the living conditions of faculty members are yet to be improved. It is quite necessary to open up some ordinary reading rooms for graduates and undergraduates to study in. Although the open-shelf reading has many advantages as we mentioned above, and it is also an effective means, for example, for the reduction of duplication of copies, yet it can't be popularly used right now, for it is only the long-term purpose we are trying for. In other words, it can only be realized by steps. For example, it can be carried out first for faculty members and students of higher grades, and then for students of lower grades.

All the measures mentioned above should be considered according to the concrete conditions of different universities concerning the decision of ratio in area between the stacks and the reading rooms. It is certain that no rigid uniformity should be sought.

In short, foreign experience should be made full use of as reference. So we must try to find out their essences and adopt them according to the conditions of our university and our country.

II. Full Attention Must Be Paid to Foreseeing Future Changes and the Enhancing of the Flexibility of Library Function

Once the library building is completed, its function is relatively fixed and is not likely to be changed. But its services and management should be regularly adjusted in accordance with the needs of the readers and it is impossible for them to remain in one form forever. This is especially the case for the university libraries owing to the fact that the installation of disciplines, teaching plans, teaching methods and scientific researches are under change all the time. With these changes the requirements

for university library will be different at different time or during different periods, so when designing a university library building, we should try to make out a scheme which can satisfy both the present demands and future long-term needs. This is the idea known as the correct handling of the relationship between the present and the future.

Let's take the library of Tsing Hua University for example. The library was constructed in the 1920's and extended in the 1930's. Its moulding is fine, its effective space available is large, and its quality is quite good, with some features of traditional style, but it was designed according to the traditional library services and management, its function has been fixed and only suitable for the common reading rooms where all the books are in the stacks or partially opened to the public. Recently, we have tried the open-shelf reading as demanded by the readers and it is greated by the readers. But owing to the functional limitation of the original structure, the low-bearing capacity of the floor of the reading room, the lack of flexibility of the partition walls, and the shortage of library space, the books on the shelves opened to the readers merely account for two or three percent of the total volumes of collection in the library. Many service programs have not been able to be carried out up to now, and therefore we have to serve the readers mainly through the means of circulation. Although there are altogether six circulation desks in service, these are still very crowded with people in front. The main reason for this is, of course, due to the lack of space, yet we have to see that owing to the fixed function of the library structure, it is very difficult to meet the new needs to the readers today.

Our experiences show that if a library is designed only with a view to the satisfaction of the present needs, it is destined that the newly constructed building will soon lose its adaptability to newer demands. Our existing library building is a warning for us, the defects of the present library will inevitably reappear in the library to come.

We think it possible that we could take into account of both needs of present and future from the following two approaches.

1st: Make a good "Foreseeing"

In designing a new library building, we should make a good "Foreseeing". We should not only consider the characteristics of the present needs, but also try to find out the needs characteristic of the future library services and its arrangements. Take the practice of open-shelf reading for example.

As we mentioned above, we should realize open-shelf reading by steps. By foreseeing, we may conceive a reading room which is now used only for self-studies and may turn into open-shelf reading room later on. A good foreseeing requires thorough theoretical researches and investigations on the basis of practice. Prophecy won't do in this aspect, but essential foreign experiences may do some good to our futurity. Therefore, we should make careful studies of the foreign modern libraries and their buildings to see how they have evolved from traditional libraries and meanwhile pay close attention to the trend of their present and future developments.

We think that the open-shelf reading is a crucial matter which demands an immediate consideration. This will inevitably bring about lots of changes in relation to problems of service. For example, how should the scope of open-shelf reading be expanded by steps? What will happen to the circulation services? And which is better, "comprehensive opening" or "professional opening"? (The former means all kinds of books are displayed on the open-shelves in the same room while the latter means only the same kind of professional books are displayed.) Should we make a distinction between faculty members and students, or treat them all the same? What changes will be brought about to the layout of the library and its way of collecting books? And so on. In addition, we should also investigate, study and foresee such problems as what effects it may have on the range of application and the contents of the electronic computers and its way of service and management. There are also some other problems which need to be studied. Therefore, it is not only necessary to make foreseeing, but also possible to do so. In a word, with these studies in view and with the characteristics of the country and the university in mind, we shall be able to make explicit demand to the library building and put forward a relative reasonable design.

Secondly, great attention must be paid to the enhancing of the flexibility of library function.

In order to meet the requirement of the expansion of the open-shelf reading room in designing, the following measures are important: adopt the framing structure and increase the load-bearing capacity of the floor of the reading rooms so that the further expansion of the open-shelf reading may be going on smoothly; adopt movable pile-up shelves in the auxiliary stack and in part of the circulating stack so that it would be beneficial to change a stack into open-shelf reading room when necessary; enlarge the load-bearing capacity of the foundation of the building in advance so that it may be

heightened with more storeys when necessary; arrange some multiple-use reading rooms (see Fig. 1, as those in Peking University) which can either be used as individual study area or be connected as one; it should reserve some ground areas for possible extention and so on. All these measures are what we think it necessary to develop the flexibility and raise the suitability of the library building.

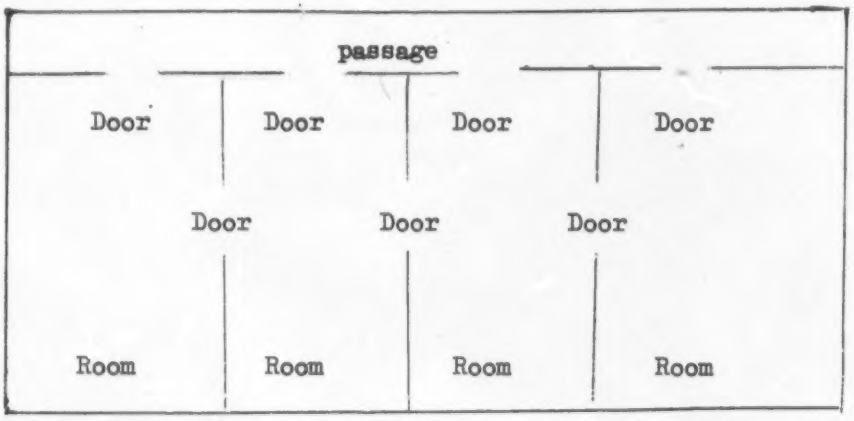

Fig. 1

Of course, it is unadvisable and to work out a design of a building that holds good for all time. Yet through foreseeing and by the adoption of flexible means, it is possible to design a library building which will hold good till the end of this century. To deal with our task in this way would be helpful for us to avoid the blindness which ought to be prevented.

III. A Proper Cooperation Between the Librarians and the Architects.

The structure of the library building is actually an exquisite combination of the library sciences, modern techniques and the arts of architecture. For a better design of a library building, the librarians and the architects ought to cooperate closely with each other. And this is especially true for our country because there has been no professional designing academy of the construction of the library building until recently. The librarians have a great responsibility for the cooperation because in practice they know better the needs of the readers and have a better understanding of the relationship of the availabilities among all the branches of a library. So, they have a greater part to play in the designing of the library building and thus are more responsible for a failure in the design.

Since the founding of the new China, a number of university library buildings have been constructed one after another. As we see, the libraries of the South-China Engineering College (built in the 1950's), of Xien Jiantong University (built in the 1960's), of Chong-Qing University, of Sucho Medical College (built in the 1970's) and many other universities, all have their own specific characteristics. According to their own opinions, one of the important experiences of designing the library building is a good cooperation with the architects. On the other hand, we have also seen a few nagative examples that some libraries were not well designed just because a poor cooperation.

Today, libraries of our country are just in a transition from the traditional ones to the modern ones. We have had quite a lot of libraries which were built according to the demands of the traditional functions, and have accumulated a lot of experiences. The practice of cooperation between librarians and architects will be great help for the improvement and innovation of the library building and for the creation of a new form of library suitable for the present conditions of our country. It is known that the librarians of the Harbin Architectural-Engineering College and the Harbin shipbuilding Engineering College are trying to make a breakthrough in the design of a brand-new library building. Their close cooperation and their spirit of daring to explore and find a new way of construction, set us a very good example, giving us great inspiration. We must double our efforts, and learn modestly the good experiences from the libraries of other universities, as well as from abroad. We ought to support and help the architects in the work of designing of library building, and cooperate closely with them, and try hard together with them to find out solutions to various problems. We believe that on the ground of close and efficient cooperation a high quality, high-efficient, economically practical, and beautiful library building will be turned out.

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LIBRARY BUILDINGS IN THE NETWORK CONTEXT:
A CANADIAN ARCHITECT'S PERSPECTIVE

by Michael G. Werleman

Library Buildings in the network context:
A Canadian Architect's Perspective

The design process in architecture should concern itself with the art of creating an improved environment as well as the science of constructing buildings with an extensive palette of materials and systems. It would appear that "networking" as has just been discussed falls into the latter aspect of design and therefore is often raised only for its technical impact on programming and as a building component system. However, architects cannot trade the responsibility of the former aspect of design with the attention given the latter. All this to say, that my appreciation of the topic here today would be more appropriately titled "Networking in Library Buildings" with a sub-heading of perhaps "Why Architects insist on starting from a different perspective".

Our concerns are as much for the supporting elements of a programme requirement as to the particular element itself, in this case "networking". And not only the supporting elements, but also independant elements having no relationship whatsoever.

Supporting elements would include such things as furniture, lighting, maintenance and so forth. Independant elements would include access to spaces, (stairs, elevators) washrooms, orientation within the building, etc.

As architects, general professional services consist, among other things, in taking the Clients' instructions. Furthermore, in the first phase of any design work, and as described in our associations standard form of agreement, "the Architect shall study the programme and budget furnished by the Client to ascertain the requirements of the project and shall review the understanding of such requirements with the Client".

It is here where the dialogue begins concerning the project in itself, and it is here where both participants try to communicate their understanding and, therefore, they begin to interpret their perspectives for each other until the two combined have become one - that which is the seed of the project.

That, however, is easier said than done. Programme precision is in itself a difficult product and its greatest obstacle is the phenomenon known as "change". In programming, past experience often becomes the basis for programme information and future judgement. Yet often the programme reflects the efforts to improve upon existing situations, using tools, systems, or

whatever to reinforce that objective. Networking and its technical development over time will forever cause library programmes to incorporate change as a "given" for new projects, renovation, and expansion of existing facilities.

Architects can accomodate change in spatial planning, building systems, and component systems, but they cannot predict the evolution of technology and its impact on library service. It is the librarian's role to evaluate the type of service that the institution is offering and, I believe it is the library consultant's role to describe the options available for the type of service envisioned. The library consultant's experience will record and develop performance data with completed projects in order to analyse future directions. Architect's should be able to recognize and evaluate trends in the space utilisation of the buildings that house these services and from there accomodate appropriate spatial and system relationships for change over time.

With the preceding, I have tried to identify that the programme definition and its inherent reference to networking is a client or librarian responsibility. Questions and issues that have been suggested for today's discussion are for example: will space be saved? or is more space required? when will the changes take place over time? and so on. These questions are actually architect-type questions to the librarian either in preliminary design communication and/or in the evaluation of facility sheets during programme analysis. Where we should provide assistance in programme elaboration is in developing spatial characteristics such as norms for various work places, in determining shared facilities and functional activities, in reinforcing, user environments with flexible and efficient organization and in minimising and/or explaining restrictions imposed by overall building requirements such as structure, mechanical and electrical capacities, and cost implications.

In terms of building planning, "flexible space" implies that change can and should be accomodated over time. How easily, how appropriately, and at what cost are immediate questions that should be asked during the design stage.

How easily, depends upon the floor, wall, and ceiling systems, in terms of space adaptable to different programme activities. Systems, including power lines and junctions for network distribution, as well as lighting grids, non-permanent partitions, mechanical supply and return outlets, and flooring materials, must all be identified for allowing change over time. How appropriately, depends more upon the environmental characteristics and the functional spatial relationships as programmed.

Artificial lighting and daylighting, structural floor loadings, buildings interior and perimeter areas, and enclosed or open areas, all affect the conversion possibilities from one activity to another. At what cost, depends upon the predictable or non-predictable nature of the changes contemplated. To initially install communications raceways for future networking throughout a library, or provide total structural floor loading capacities for stacks (whether for expansion or relocation), or to maximize perimeter glazing of a building to accomodate full potential for study/lounge seating areas, would all represent extreme judgments for future change and probably entail costs which would never return the initial investment.

Presently, in joint venture, we are designing a central university building for Concordia University, here in Montreal, in which the initial space requirement for its library represents more than half of the building itself. In this mixed-use university building, the library itself has the potential to grow into non-library space. However, it is also possible that due to space norms, or with an increase in print storage requirements, or the conversion of space to non-university space use, the library will have to expand and/or adjust its space within its original size. Our mandate requests that the "building should be sufficiently flexible to allow accomodation to change and advantage to be taken of new technology". We have spent the first months of design on organizing 7 floors of library in 12 floors of building and for the most part providing "loft-type" floor areas (which are large open areas available for flexible interior space planning) approaching 30,000 net sq. feet per floor. On these floors we have completed the functional organization and layering according to the programme requirements, and it is only now that we are testing these layouts with the building systems and elements to determine just how flexible a facility we have designed. We have essentially identified the following areas on each floor.

- seating/study/lounge and/or office area
- stack area
- information, orientation, miscellaneous area
- expansion/reduction area (including compact storage facility)
- the core (a shared area)
- non-library office function area (adjacent to the library on each floor)

The systems we determine to serve and support the areas mentioned must reflect the possibility and appropriateness for change. Areas next to each other should be judged to have the potential for expansion and/or reduction. The programme should describe

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this requirement, yet consideration must be given to the separation of two related areas to another location or floor should the area available be too restrictive.

To return to the actual Concordia example, we can simplistically divide its floor area (which as a structural design standard will have typically 150 lb/sq.ft. for stacks) into 10 sections. One section for the core-a static element. Two sections for offices, - available for possible library expansion; also a good area to consider for a network distribution system either in the ceiling or in the floor - this being a cost consideration. One section becomes library or office space initially - this will be structurally designed for future compact storage. The remaining six sections respond to pure library programming with approximately two sections for seating/study areas, approximately two sections for stacks, and approximately two sections for information, terminals, and miscellaneous activities. A network distribution system will most probably be considered initially for these last two sections which are centrally located to the geometry I have been describing. Future potential for this system will probably be planned for the ceiling or floor of the stack area, and nothing more for the seating/study area other than perimeter wall distribution potential. Consideration of the natural daylighting at the perimeter is one main factor for this latter reasoning.

The object of this exercise is to try to show the basic planning once a floor area has been established and a building core (elevator, stairs, washrooms, mechanical and electrical rooms) has been located. We are left then with perimeter space, internal space, and adjacent core space. Now, no matter how similar the building systems and elements and materials are, the spatial, physical, and psychological environment differs at the perimeter, the interior, and the core. The interior architecture will reflect this by its activities (spaces prefering natural light, spaces requiring privacy etc.) by its organization (orientation, furnishings etc.) and by condition (permanent walls, public services, etc.). Therefore, an architect will be concerned for the appropriateness of space for eventual change. Obviously, if a building has been designed with continuous exterior glazing (whether it be for aesthetics, standardization, or whatever) then the perimeter area is immediately less appropriate for those activities not requiring natural light. Conversely, to design a building with virtually no windows with the thought of providing total electronic or audio-visual environments seriously inhibits the users' appreciation and enjoyment of the building. All this to say, that with proper study of preliminary design layouts, the determination of probable areas for distribution systems can be identified for future change without an overkill of unrestrained installation.

The basic distribution systems to date for power and communication services are found in the floor and/or ceiling, being essentially linear metal containers (pipe conduit, bus ducts, raceway troughs, etc.) bringing power, data, and telephone lines to service points and work stations. The most expensive part of the system is bringing the main service to different circuit distribution points. From an electrical, data, telephone entrance to the building, then to smaller electrical and telephone rooms per area or per floor, then to points serving each circuit, the distribution can generally provide outlets at 100 sq.ft. centres. In a concrete floor system in which the raceway is set into the concrete permanency is established; also if not initially provided, future installation is impossible. Experience to date for such a traditional system, and based upon 100 sq.ft. centres, has cost at around $5.00 per sq.ft. Bear in mind that in such a concrete building, the raceway must be included during initial design and construction if the flexibility is warranted. It is virtually impossible for me to make cost evaluations for the electrical power capacities required for future network distribution systems. Electrical rooms allowing for future expansion must provide wall space for additional panels and electrical and telephone entrances must be sized to accomodate future equipment. Overall, these considerations, although necessary, should not particularly influence the basic planning and space accomodation relative to the net programme requirements, since these spaces fall beyond the net programme requirements. In other words, the architect and engineer, if imaginative and efficient, can successfully manipulate the approximately 30-35% area for building utilities, walls, public access, and miscellaneous services that support the net building programme.

To play with cost figures for integrated floor raceway systems for a moment, I will use the Concordia University example of library programme square footage. With approximately 160,000 net square feet of requirements, a library building results with around 240,000 gross square feet. If we use $60.00 per sq.ft., a construction cost of $14,400,000. results. My previous example of floor area use was based upon approximately 24,000 sq.ft. of library floor. If we provide raceways for the information/assistance/orientation area, and for the stack area for future flexibility, then 50% or 12,000 sq.ft. of library floor at $5.00 per square foot makes a cost of $60,000. per floor. Using 6 floors this way, $360,000. of raceway installation, on top of $14,400,000. for the library building, gives almost 2½% relating to the overall costs. Compared to the overall electrical costs of about 10% of the total construction, this would increase this trade element alone by 25%. And finally, in typical construction cost comparison, the

installation would represent $1.50 per square foot of the total construction.

Another typical raceway distribution system is that which is located between a structural slab and a suspended ceiling and, via power poles, outlets drop vertically from the ceiling to work stations. The obvious disadvantage to this is the visual obstruction of these elements throughout open areas. However, the cost for such a raceway system is practically one-half to two-thirds that of the in-floor system. A further advantage is that future installation can be considered only when actually necessary.

Another system has only recently been developed and consists of flat conductor cable (described as about 3 business cards thick) which is applied and taped on top of a floor and underneath a system of carpet tiles for immediate access. Born from the technology of the National Aeronautics and Space Administration in their spacecraft research, power, communication, and telephone lines can be distributed extremely easily and quickly with the obvious advantage of adapting equally to new and/or existing buildings. We have recently carried out a building expansion here in Quebec for Thomas and Betts Ltd., an electrical component manufacturer, who produces the product by their trade name of "Versa-Trak". As a pilot project in Quebec, the cost per square foot ran about $2.00 per square foot of installation or approximately $1.20 per sq.ft. of total construction cost. Another implication with this system is the mandatory (as in the United States electrical codes) carpet tile system which must cover this. Good carpet tiles cost about $3.00-$4.00 per square foot as opposed to conventional carpet installations from $2.00 - $3.00 per square foot or $1.00 - $4.00 for various resilient flooring materials. (Remember as well, that the life-cycle costing of a carpet tile installation should be better than a conventional carpet installation because of maintenance-factors, such as rotation of tiles, selective unit replacement, etc. Overall, the potential development of this cable system and accompagnying carpet system is enormous and will, I believe, be as competitive and flexible as anything we have seen.

Certainly, if the capacity for eventual change is or can be accomodated in a library for network installation, then furniture, work stations, moveable partitions of various heights are being and will further be developed to plug-in to communications circuits becoming the distribution system in themselves. The progress from traditional offices to open offices to work stations, to automated work stations continues.

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One resulting aspect of this trend, is the consideration of sharing physical space or equipment with other users, thereby diminishing the privacy often enjoyed. Another more direct programme ramification may be that functions and activities that had not been related historically may become so in the effort to forecast flexible, efficient, and economical change. Another development may see the evolution of laboratory-type design for terminal clustering allowing through-wall and through-furniture hook-ups. Furthermore, if furniture and equipment groupings prove appropriate, then structural columns may provide the source for vertical attachments from ceiling distribution systems, and become the centre from which activities radiate.

In conclusion, I would not be convinced that networking as a phenomenon will change library architecture from what we know it as today to an entirely different building type. The service of libraries is based upon the intellectual and educational benefits that any institution decides to offer. The tools may change to provide material and the time frame may be reduced to acquire that material, but the material will increase inexorably, and people will still want the choice of learning in a library or away from it. Libraries are social places, work places, and learning places. The environment must primarily respond to that more than to the systems that serve it.

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Library buildings in the network context

by

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Abstract.

New technologies, particularly those of the computer and telecommunications, will have a tremendous impact on library operations in the next decade. These technologies, in addition to the environment of financial restraint, will encourage the development of a variety of library networks and participation by libraries in them. The implications for library buildings of such participation is described in terms of collection space and access, staff space and organization, user needs, changing functions and functional relationships and mechanical/electrical/structural considerations.

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I. Introduction.

The past 20 years have seen massive changes in the operation of all Canadian libraries. A variety of new technologies - automation, telecommunications, computer output microforms, videodisc, videotex - have and continue to have an impact on library systems and services and on the buildings which house them. Before the implications for library buildings can be identified it may be useful to review briefly the specific technologies and various networks which are applicable, at least in Canada, and assume that there will be relevance, either now or in the future, to library buildings in other parts of the world.

II. Technological impacts.

1. Computer.

As in the rest of the world, the most important and far reaching technological development in Canada has been the introduction of the computer into library operations. It has had an impact on libraries of all types, - academic, public, government, school, industry - most frequently through involvement in one of the various networks which will be described later.

The computer has been used, primarily, to convert former manual card catalogue records to machine readable form, allowing the creation of new types of access to library collections. There are many Canadian examples of two kinds of catalogues:

COM catalogues, which are machine readable catalogues produced on microform; or online catalogues, which allow the user to access the library holdings directly through public inquiry terminals.

Based on the machine readable catalogue records, automated circulation systems have been the most frequently implemented automated system in Canada. Using one of several turnkey systems, medium sized to large public and academic libraries have eliminated manual files and time consuming manual circulation routines, greatly improving their responsiveness to user needs.

In addition to these major systems for cataloguing and circulation, many libraries have also introduced automated systems for acquisitions, periodical listings if not check-in, government publication organization and control, and to a lesser extent, systems for films, maps, theses, archives and other non-print materials.

2. Telecommunication technology.

The combination of telecommunication and computer have created an entirely new dimension in information retrieval. All Canadian academic libraries, most medium to large public libraries, special/government libraries, and regional library systems regularly access bibliographic data bases stored on large centralized commercial computer systems such as Dialog, or the national Canadian system CAN/OLE.

Electronic messaging is the newest communication service impacting on library operations. Using electronic mail systems supplied by a vendor or designed locally, libraries can identify a needed title held by another library through online access to its catalogue file, and then request that title on ILL through an electronic message. Within a campus or a city public library system it is anticipated that electronic messaging will reduce the paper messages now being copied to so many staff members, and will increase productivity for the entire system through elimination of face to face meetings or of time consuming telephone calls.

3. New formats.

The acceptance of publications and their contents in new formats, most particularly microform, has become commonplace in all Canadian libraries. There is also a greater emphasis on use of non-print media such as video and audio tapes and cassettes, on film, and particularly in public libraries, on media such as cable television.

Newer formats such as videodisk or information dissemination systems such as videotex are in experimental stages so that their impact can only be anticipated.

III. Networks.

Since the end of World War II Canadian libraries have been struggling with the problem of an ever increasing output of world publications at a time when, except briefly in the 60's, financial support did not allow sufficient funding for either acquisition of all needed material or adequate space to house the growing collections. The last two decades have seen an improvement in the political and administrative mechanisms for sharing resources, thus making it possible to increase library effectiveness at the same time as expenditures have been held or decreased. In Ontario, for example, there have been coordinating agreements for university, college and government libraries, with public libraries legislated into county and/or regional systems. The new technologies described above have encouraged the development of more formalized consortia, and the last decade has seen the development of truly effective library and information networks.

There are a variety of such networks in Canada and it is not unusual for an individual library to belong to more than one, particularly since the National Library has played a leadership role in creating a decentralized library and information network for Canada. This model, which is a distributed rather than a star network, encourages individual libraries or regions to communicate and share resources directly with each other rather than depending on a single central facility for each request or exchange of information. The National Library, rather than attempting to build, in Ottawa, one comprehensive total resource for all of Canada, has encouraged the acquisition and enhancement of special collections in many libraries across the country.

Such dispersal of the country's resources has necessitated the strengthening of the linking of all libraries so that the country's resources will be known and available to all Canadians. As part of this national network, CISTI, the Canada Institute for Scientific and Technical Information, has also played an important role, specifically given the mandate for the dissemination of scientific and technical information.

In addition to this national network which provides the framework for Canadian cooperative resource sharing activities, there are several other types of networks which have implications for Canadian library buildings:

First of these is the type of library network, which is most common in provincial jurisdictions, and sees a banding together of like libraries. For instance, Ontario, Quebec and British Columbia have university library networks, OOCUL, CREPUQ and TRIULL), while the other provinces have grouped together to create two inter-provincial networks based on their geographic contiguity.

Typical of the services provided by type of library network are computer produced union lists, reciprocal borrowing, collection rationalization, transit systems, cooperative storage, and shared use of automated systems.

Also present in Canada are provincial networks, in which all types of libraries in one province belong to a network. In British Columbia, for example, the government has funded a union catalogue system, B.C.U.C., which provides automated catalogue support services and encourages resource sharing for university, college and public libraries. Similar concepts, with a greater or lesser degree of computerization, exist in other provinces, the oldest and most successful being the Nova Scotia union catalogue network.

Local or regional networks are becoming more common particularly in the counties of southern Ontario as libraries of different types, such as university, school and public, link through their close geographic relationship to form informal distributed networks.

A campus network which is really a specific example of a type of library network, emphasizes the importance of the existence of a library/information network within one university and has implication for library facilities on that campus. Faculty members capable of accessing the library catalogue via terminal in their own home or office and requesting that a title not held be ordered or that another title be placed on reserve; or students with the capability of accessing the same data base from a residence room and placing a hold on a needed title, or of determining that he/she has books overdue can create tremendous changes in the way library resources are perceived and used.

Although more commonly known and used in the United States, networks based on a commercial online bibliographic utility which supplies catalogue products and facilitates interlibrary lending through access to its union data base cannot be overlooked. OCLC, the largest of such utilities, has more than 2000 American library members and a data base of five million unique items. In Canada, UTLAS provides similar services and the Ontario college library network based on a centralized computerized cataloguing facility, the Bibliocentre, should also be mentioned.

IV. Response of Canadian library buildings.

With the introduction into Canadian libraries of the new technologies and networks described above, how have their buildings, so many of which were built in the late sixties and early seventies, fared? It is not too surprising to suggest that many did not adjust well. Larger libraries built with specialized computer rooms now find these facilities over spacious and over designed. Small or medium sized libraries regretfully have no space at all assigned to computer or system functions. Libraries designed for centralized card catalogues in close proximity to large technical service staffs have found it difficult to provide dispersed access via online terminals or COM catalogues throughout the library building: the mechanical/electrical facilities were insufficient. Permanent walls have not allowed the space released by diminished technical or card catalogue functions to be used for public or collection services.

Administrative or management activities have suffered most from lack of space, and few buildings provided the capability for expansion or for change of library organizational structures and systems. In fact, the flexibility demanded by some librarians and library consultants in the late sixties was the correct solution and not enough was provided. Flexibility to move collections, services, functions, equipment, and facilities to new locations within the building; flexibility to restructure the staff organizations which provide the service; flexibility to introduce new services, often requiring new technology; flexibility to economize and eliminate separate service desks unimpeded by permanent walls; flexibility to change management systems or styles; all were needed and continue to be needed in the Canadian library environment.

If Canadian library planners and architects of the past few years failed, in large measure, to identify the implications of new technology and the network environment, what should be the direction for the next generation of library buildings or additions and renovations which will exist entirely in computer based electronic library and information networks? What directions should be taken so that the implications of the new technological and network environment can be identified, and the flexibility required for future change can be assured?

It would be presumptuous to attempt to answer these questions but, at the least, implications of the technologies and networks can be categorized and viewed against the background of buildings which have been less than successful in accommodating themselves to this new environment.

V. Implications.

1. Collection space and access.

The need for increasing space for library collections cannot be assumed to have halted due to involvement of Canadian libraries in resource sharing computer based networks, but the rate of collection growth has nevertheless decreased, primarily due to financial restraint. Microform collections for back issues of periodicals will be increasingly accepted if not popular in all types of libraries, particularly for university/research library resources. As well, fewer periodical titles will be needed as convenient access to regional, provincial and national collections is provided through the networks. The requirements or implications of the newest collection formats - videotex, electronic micro-publishing, videodisk - cannot yet be specifically identified, but their place in library collections must be determined.

In addition to these challenges to the former standards for collection space requirements is the increasing popularity or necessity of compact storage, in the library, on campus, or shared with other libraries in a common network. Machine readable records have made such storage a workable solution for housing little used material, since access and retrieval are simplified and enhanced. Such storage will never assume a large share of collection space in Canadian libraries, so committed to open access for as much of the collections as possible; nevertheless, allowance should be made for such facilities in all but the smallest libraries, and this will have a bearing on collection space standards and calculations.

In projecting volume equivalencies for the disparate collection formats just described it will be necessary to consider additional floor loading capabilities as a collection requirement in several areas of the library, if not on all floors of a multi-floor building. In order to protect against the heavy weighting which the housing together of several different collection formats might require - videotex, microform, compact storage - structures with more than the now standard 150 lbs. per sq.ft. live load may become a necessity.

But in addition to careful projection of volume equivalencies for the different collection formats it will be equally important to identify policy for their use, both in and out of the library. Traditional methods of organizing and separating library collections by format, with separate rooms or floors and different access or use policies for each - documents, current periodicals, microforms, maps, films, non-print, rare, pamphlets, books, periodical back issues, reference, archives - has already created unnecessary complexity and confusion for the library user. As even more

formats are added to our collections, flexibility in the planning of the library system for organizing the collections for use as well as for designing the building which is to house them will be required. This, coupled with the floor loading discussed above will present an even greater challenge to the architect.

2. Staff.

Staff members and staff organizations have also changed as the result of new technology and library networks. The online acquisition and catalogue support systems have resulted in the need for far fewer technical service staff. At the same time, introduction of online retrieval services has increased the need for public service librarians and assistants.

As well, new types of library staff are needed. Involvement in the computer based networks has required local library expertise in the form of systems analysts or system librarians. In-service training programs to improve staff capabilities in use of sophisticated systems and services has placed emphasis on the personnel function, and personnel librarians and administrative assistants are common in all larger libraries. Other administrative staff numbers have also increased, as resource sharing network involvement and adoption of new technology has required more proficient management systems and managers. Participatory management concepts, with more staff members involved in decision making, has emphasized the requirement for staff meeting and/or conference rooms as an adjunct to staff work stations.

The space requirements for individual library staff has also changed, as terminals, modems, printers, even microcomputers became standard equipment for many staff members. Larger space allocations for each staff member must be assumed, particularly in this transitional period, as typewriter and

terminal compete for attention on the library assistant's desk, and as each cataloguer requires a terminal in addition to all the classification and authority tools which now surround his work station. The former overall allocation of 150 square feet per staff member suggested by Keyes Metcalf, or even 175 square feet suggested by others, may be insufficient in the network context.

3. Users.

More sophisticated facilities in closer relationship to the collections can be defined as user requirements. Individual carrels supplied with light and electric outlets and with sufficient space to hold viewing equipment must be accepted. Communication outlets which allow a terminal or microcomputer to be used at each carrel is an ideal which may soon be a standard requirement, and the capability, at least, for this provision should be planned.

Microform readers and printers and photocopy equipment are required throughout a library, not just in one location, as library users, with more access to more resources, wish to have capability for use of many resources in one location, just as they now have access.

We can therefore predict that more space per user will be a requirement, as each reader station acquires a more sophisticated environment. Thirty or 35 square feet, rather than the present 25 would appear reasonable as the standard for user space allocation. The number of reader stations to be provided in each library seems uncertain, however, as the capability of the newer resource formats for use from remote locations such as home, office, or dormitory has an as yet undertermined influence. It may be that fewer but larger reader stations, at least in the university library, will be the compromise.

4. Functions and functional relationships.

The once all important relationship of library catalogue to technical services staff is no longer valid, as microform or online catalogues allow library staff to use the catalogue in their work from any location in the building or even in another building. Although not necessarily a desirable situation, many technical service staffs now operate from facilities some distance from the central collection and from public services, with no detriment to the library system or services offered. For many public and college libraries totally dependent on a bibliographic utility or central processing network, the technical service function no longer assumes the importance it once held in the total library operation.

The reciprocal borrowing arrangements, encouraged by network agreements and easy online or microform catalogue access, has placed increasing importance on the relationship of circulation to security control. Automated circulation systems which can identify patrons in good standing, inform them that reserved books are available, or indicate the amount of fines owing, are best used in conjunction with security systems which stop the removal from the building of materials which cannot circulate or which cannot circulate to a particular patron.

The public aspects of interlibrary lending or reciprocal borrowing have also increased in importance. These functions need to be located so that they are available to users in non-peak hours, thus dictating that the relationship of interlending to basic borrowing services becomes more important than to the reference function with which it has more traditionally been associated.

Network involvement has also changed the nature of library work, as access to computer facilities often must be spread to off-peak hours to ensure economies of operation. Library staff schedules have therefore become more diversified, requiring regulatory procedures for equipment use and for building access and exit. Need for equipment maintenance on site has also expanded so that the combination of new technologies and networks has created a demand for a much larger building/equipment/security function than was previously required.

Specialized functions such as online retrieval, systems development, orientation and instruction, videotex services, film and videotape previewing or viewing, also demand specialized facilities within the library building, and their relationship to existing or traditional functions must be established.

5. Mechanical/electrical/structural considerations.

It is obvious that one of the most direct implications of the technological and network developments has been the electrical/mechanical/structural requirements imposed on library buildings. Electrical outlets are required everywhere so that individual carrels and dispersed service centres can contain lighting and equipment capabilities. Communication outlets, desirable at dispersed locations throughout the library, imply attention to provision of adequate conduit for coaxial cable both vertically and horizontally throughout the building. Fibre optics will decrease the size of conduit needed, but will not eliminate the requirement. Ideal would be communication cable, with electricity, in underfloor conduit everywhere in the library floors. Since this would be an expensive solution, a compromise of such capability in every column and in ceiling space may have to suffice.

Microcomputers have had and will have increasing implications for library systems. Once considered too expensive for all but the largest libraries, computers will become commonplace in even the smallest. The centralized computer room with special air-conditioning, power supply, and raised floor, will not be a necessity for this new microprocessing technology, although special attention to air-conditioning and humidity control in the library building will always be a requirement, due to combined needs of staff, user, equipment and collections.

6. Library system organization.

The distributed access to library collections made possible through the computer based catalogue access systems, either local or through regional or national networks, has influenced attitudes toward branch libraries within government or commercial organizations, in city and regional systems, or on college and university campuses. During the last decade, the rising cost of operation forced many library jurisdictions, particularly those of Canadian universities, to question the effectiveness of decentralized library systems. With branch libraries open fewer hours and minimally staffed, it was argued that the user would be better served with access to a larger collection with more service, albeit at a greater distance from his classroom or research activities. Many campuses therefore merged branch libraries into divisional libraries - physics, chemistry, mathematics, computer science - into Science libraries; biological sciences and medicine into Life science libraries, etc. Now, however, availability of a campus electronic network may reverse this trend, as organization and access costs for individual library locations are greatly reduced. It is too soon to predict with any accuracy what direction library system planning - for either campus or city - will take, but a new model is certainly possible and must be considered when any new building or renovation is contemplated.

VI. Conclusion.

It would appear, therefore, that all concepts of librarianship, all policies, all standards, must be challenged if we are to successfully plan buildings that will encourage efficient and effective service in this new network environment. The library building, as much if not more than other buildings, must reflect and accommodate the functions it houses. At a time when these functions can be stated with less certainty than previously, it would appear reasonable to suggest that a flexibility that will permit limitless possibilities would be a wise choice. Since such flexibility would undoubtedly be both expensive and less than aesthetically pleasing, compromise will undoubtedly result. As Canadian librarians and architects move more completely into the network environment and begin to plan for the libraries of the information age let us hope that the compromise they reach will be based on informed analysis of changed information resources, and a sensitive response to user needs for access to them.